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Council of Industrial Design

Foundrymen have without serious difficulty managed to supply the current requirements of civilisation. Moreover, as the two most popular alloys, cast iron and bronze, have very good weather-resisting qualities, there is much tangible proof available to verify this assertion. A more intensive search would reveal that only in a limited field is the foundry owner responsible for his own designs, and this condition largely exists to-day. The foundry industry is not unique in the realisation that its future is bound up with designs over which it has but little control. The Government has taken cognisance of the prevailing conditions, and the President of the Board of Trade—no doubt with an eye on post-war exports—has called into being a Council of Industrial Design, and has invited Sir Thomas Barlow to preside over its deliberations. The Council is to operate much on the system established by the Department of Scientific and Industrial Research; that is, various industries will be helpful to create centres, whereat by every means possible the general level of industrial design will be raised. Then the Council is to aid the popularisation of well designed goods by holding or supporting exhibitions. Where the Government is itself responsible for the organisation of a British Pavilion at an international exhibition, it will exclude manufactures not reaching the standard set by its export committees. Certainly a more enlightened policy is necessary than the one in vogue at the time of the last Paris exhibition, which left one with the impression that half the population of this country was engaged in the craft production of sports goods.

Exhibitions are not all honey. The May to October variety results in stands being staffed by commissionaires and office boys—only the fun fair flourishes. The B.I.F. at Castle Bromwich, held as it was in February, seemed to benefit the medical profession more than the manufacturer. Moreover, overseas buyers are indistinguishable from the copyists, especially in those days of national sufficiency.

The next duty of the Council is to co-operate with the educational authorities, in order to ensure that the student of design is armed with the requisite knowledge of industrial limitations and possibilities. To put this on a potentially practical basis, a number of industrialists have accepted Mr. Hugh Dalton's invitation to serve on the Council and its Scottish Committee. On the latter, the light-castings industry is represented by Mr. William Rennie, the chairman of Federated Foundries, Limited; Mr. J. H. Tresfon, managing director of Boulton & Paul, Limited, chairman of H. Widdop & Company, Limited, and a director of several other engineering companies; whilst Mr. Leslie Gamage, who is a member of the Council, has, as director of the General Electric Company, extensive foundry interests. Many of the proposed activities of the Council are not new. The Royal Society of Arts, the British Colour Council, and the Building Centre are but three of a large number of activities, the objects of which were in the main directed towards the improvement in the design of manufactured articles. The creation of the new Council gives credence to the hope that due importance will be given to design, just as in recent years increasing stress has been laid upon scientific research.

How necessary it is can best be shown by reference to our pre-war export figures, where no less than two-thirds of the amount sold depended almost entirely on design. Moreover, superiority in design, but not in quality or workmanship, made Britain a ready market for increasingly large quantities of foreign material. In some countries exclusiveness has given way to well-designed, mass-produced articles, and this tendency will grow.

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FORTHCOMING EVENTS

JANUARY 15.

Sheffield Society of Engineers and Metallurgists :—Annual general meeting and lecture on "Ship Model Testing," by A. Emmerson, of the National Physical Laboratory.

Institute of British Foundrymen

JANUARY 6.

Lancashire Branch :—"A Study in Wear and Grey Cast Iron," by H. J. Young. At the Engineers' Club, Albert Square, Manchester, at 3 p.m.

Lincoln Section :—"Metallurgy of Cast Iron," by A. E. Peace. At the Technical College, Lincoln, at 3 p.m.

JANUARY 9.

Burnley Section :—"A Small Foundry in Wartime," by F. Lord. At the Municipal College, Ormerod Road, Burnley, at 7.30 p.m.

JANUARY 13.

Bristol Branch :—"Bronze Castings," by E. J. L. Howard. At the Grand Hotel, Broad Street, Bristol, at 3 p.m.

Scottish Branch :—"Control and Foundry Production of Grey Iron and Special Duty Iron Castings," by R. R. Taylor. At the Royal Technical College, George Street, Glasgow, at 3 p.m.

West Riding of Yorkshire Branch :—"The Centrifugal Casting Process for the Production of General Castings," by Dr. J. E. Hurst. At the Technical College, Bradford, at 6.30 p.m.

JANUARY 22.

Sheffield Branch :—"Joint meeting with the Iron and Steel Institute. Discussion of a Paper by W. Davies and W. J. Rees on "The Effect of Grain Shape on the Moulding Properties of Synthetic Moulding Sands." At the Royal Victoria Hotel, Sheffield, at 7 p.m.

JANUARY 24.

London Branch :—"Gunmetal Bearings," by F. Holligan. At the Charing Cross Hotel, London, W.C.2.

JANUARY 27.

East Midlands Branch :—"Moulding Sands and Gases in Relation to Casting Defects," by G. W. Nicholls. At the Technical College, Derby, at 6 p.m.

NOTES FROM THE BRANCHES

Lancashire Branch.—The November meeting was held at the Engineers' Club, Manchester, Mr. A. Hopwood presiding. The meeting was devoted to the presentation of a Paper by Mr. A. R. Palmer on "Gravity Diecasting." It was announced that the annual dinner would take place on February 17 at the Engineers' Club. Tickets will be 12s. 6d. each.

Scottish Branch (Falkirk Section).—The previous best attendance was doubled at the last meeting of this Section. Mr. Ronald Taylor presided, and the lecturer was Mr. J. S. Hales, B.Sc., of the British Coal Utilisation Research Association. His subject—rather an unusual one for a foundry audience—was the "Design and Testing of Space Heaters." It is hoped to publish a *résumé* of this Paper in the near future.

SOUTH AFRICAN BUREAU OF STANDARDS

The South African Government has the intention of creating a Bureau of Standards. This will amplify the work of the South African Standards Institution by the organisation of a physical laboratory, at which instruments can be calibrated, research work undertaken, and commodity standards—especially for food and drugs—can be established. The enabling Bill has had its first reading.

ECONOMY IN THE USE OF CHROMIC ACID

Anodising.—Reduction in the consumption of chromic acid used in anodising baths may be made by reducing the time of anodising or, subject to approval and the availability of the necessary equipment, by changing over to sulphuric acid in place of chromic-acid solution. D.T.D. Technical Circular No. 283 (Issue II) should be consulted for particulars. Anodising may be unnecessary as a preparatory treatment to improve the efficiency of paint or lacquer films, and for some purposes a satisfactory result may be obtained by a non-electrolytic immersion treatment in a suitable solution; for example, the M.B.V. treatment or its proprietary equivalent may be used. The M.B.V. treatment consists in immersion for 4 to 5 min. in a hot solution (90 to 100 deg. C.) containing 2.5 per cent. of sodium carbonate and 1.5 per cent. of sodium or potassium chromate.

Metal Finishing Treatments

(1) *Bright Dipping of Zinc.*—It will be readily understood that this treatment, carried out for the sake of appearance alone, is of no consequence at the present time. The use of solutions containing chromic acid should be discontinued for this purpose.

(2) *Pickling Baths.*—(i) Aluminium: For pickling solutions containing chromic acid and sulphuric acid, crystalline sodium dichromate should be substituted for chromic acid (*e.g.*, solution II of D.T.D. 915.A). (ii) Copper and Brass: The following composition should yield a satisfactory pickling bath:—

Sodium dichromate cryst.	200 g.
Sulphuric acid conc.	40 ml.
Water	1 litre

The use of chromic acid for making this type of pickling solution should be discontinued.

CATALOGUE RECEIVED

Hardness Testing.—A leaflet received from the Harry W. Dietert Company, of 9330, Roselawn, Detroit, 4, Mich., U.S.A., describes and illustrates two pieces of apparatus, the first of which is for ascertaining the hardness to which a mould has been rammed. Very soft moulds give a reading of 20 and very hard 85. It is an instrument about the size of a watch, and makes a hemispherical impression on the mould face. The second serves much the same purpose for core testing. In this case the instrument has a Carbaloy point, which is either pulled across the surface of the baked core or pressed into it. If it be used for testing dried moulds, it will give a reading of 20 for soft ones, whilst very hard cores will register 95.

Metal Treatment, Limited, is being wound up voluntarily. Mr. N. S. Hunt, 15, Cromwell Road, London, S.W.7, is the liquidator. [Note: Metal Treatment, Limited, is in no way connected with our associated quarterly, "Metal Treatment."]

A METHOD OF STATISTICAL QUALITY CONTROL INSPECTION OF LIGHT ALLOY CASTINGS*

An adaptation of the method of the inspection of machined components

By F. A. ALLEN

Introduction

Statistical quality control is a topical subject wherever inspectors and production engineers are gathered together. The method has hitherto been applied as a general rule to control of manufacturing processes in which the product has some defined measurement which has to be met for acceptance. Tolerances allowed in drawing dimensions are really concessions to the inaccuracy of machining processes. It is precisely for this reason that the application of quality control to the inspection of machined components is attractive, for not only is 100 per cent. inspection shown to be unnecessary providing the points on the control chart fall within the limits indicated by statistical analysis, but, of perhaps more value, is the fact that the efficiency of production is known currently; inspection and production data are then up-to-the-minute in a way that cannot be secured by any other method.

The present Paper describes an adaptation of the method to the inspection of light alloy castings. It could, indeed, be applied to the inspection of castings in any metal, but it may be agreed that the founder of light alloy castings for the aircraft industry has to contend with inspection methods more searching than usual in other branches of the foundry industry. The manner in which many light alloy foundries attempt to make certain of the requisite high quality of production was excellently exemplified by Warrington's recent description[1] of a pre-production experimental routine.

The production of acceptable castings, however, depends upon the control of many variable factors, which, it may be suggested, are more difficult to control in the production foundry than in the experimental stage. It is necessary, therefore, to maintain a constant check on quality of production in order that unwitting departure from the manufacturing process laid down, or the disastrous operation of a chance factor, may be observed with no loss of time. It is a fact that an efficient pre-production scheme should be matched by an equally efficient post-production inspection system.

One attempt to apply statistical control to tensile strength results of test-bars[2] was described recently, but while this trial made use of what may be called the normal method based upon measurable quantities, the method to be described here makes use of the simpler method of "fraction defective" inspection.

Description of Method

It may be as well at this stage to summarise briefly the method of statistical quality control. In any production process it will be found that no two results are identical, even in spite of modern engineering methods. The tolerance allowed on all machining dimensions is a concession to the fundamental lack of absolute accuracy in engineering production; as a matter of common observation, it is well known that the tolerance allowed varies from job to job—sometimes the range between upper and lower limits is small as in the highest class of precision work, and sometimes the dimensional interval is wide. The establishment of tolerances has an important bearing on the rate of production, on the type of machine tool used for the operation, on the class of labour employed for the job, and finally, of prime importance for our purpose at present, on the amount of inspection required on the resultant component.

If one were assured that machine and operator produced a constant result of accurate dimension, no inspection whatever would be necessary; conversely, if machine and operator were such that wide variations in dimension were produced, complete inspection of every part would have to be undertaken, and in all probability large amounts of scrap would be revealed. It is between these extreme cases that the engineer tries to work.

The two limiting cases quoted may be described in another way: in the first instance, the highest degree of manufacturing control is operating, while in the second, manufacturing control is lacking, and production control is only exercised by inspection after much effort has been expended wastefully. The degree of control can be ascertained on any process by statistical analysis of the results obtained, and control limits arrived at by this method can be graphically presented on what is known as a control chart. It will be clear that control limits so determined must fall within the upper and lower drawing dimensional limit for any degree of efficiency of production; if they did not, it can be confidently stated that many major factors were operating against the production of uniform results. Such factors may be unsuitability of machine or lack of skill on the part of the operator.

It must be pointed out that the points plotted are

* A Paper presented to the Bristol and West of England Branch of the Institute of British Foundrymen, Mr. E. Griffin presiding. The Author is Chief Metallurgist and Chief Inspector, Magnal Products, Limited, Bristol.

Statistical Quality Control Inspection

the result of averaging the individual measurements of a number of components, so that the effect of a chance scattered reading is minimised, and does not normally materially affect the position of the point. Nevertheless, if a major change is impressed on the process and all the readings are, for example, too high, the resultant average point will move away from the existent level. When this happens on consecutive samples, it will be evident from the chart that there is a trend towards incorrect dimension, ultimately resulting in results outside the control limit and moving dangerously close to the drawing limit, and which, if the trend be not checked, will result in the production of scrap work. This indication of trend, therefore, provides a warning that something is going wrong, and an investigation should be made to determine the cause. In statistical language, the process is no longer in control.

The advantages of the method are as follow:—When a manufacturing method is shown to be in control, inspection need only be sufficient to check the maintenance of control; with the control chart, an up-to-the-minute record is provided of efficiency of production; following upon these obvious advantages are the further facts that adequacy of tool and labour for any particular job can be more certainly known, and that inspection costs may be reduced, providing control remains at the required level.

Object of Pre-production Process Planning

It was decided to see if a similar system with all its advantages could be applied to light alloy casting inspection. As intimated earlier, the successful production of any casting is at the mercy of many factors, and the object of pre-production process planning is to define the manufacturing method so accurately that the operation of unknown factors is eliminated. Inspection, therefore, cannot be defined to one value, but must embrace the many aspects of soundness, often determined by radiography, absence of foundry defects, and dimensional accuracy to mention but a few.

In spite of these aspects of castings inspection, in practice the inspection of any particular part number most often is compulsorily concentrated on one or two of the above mentioned departments of inspection. An example may be quoted: a stressed casting is being produced by first-class pattern equipment giving dimensionally accurate results, and thus no rejections are expected on this score. Yet the casting, being highly stressed, has to be examined by the more searching method of radiography. Dimensionally correct castings are more or less frequently rejected at this stage for comparatively minor defects.

Another casting, also produced with the highest dimensional accuracy, requires to be pressure tested, and quite often this method appears to be more stringent than radiography, possibly because personal judgment of the chief inspector may be exercised in assessment of doubtful cases in radiography, while a leaking casting on a test-rig leaves no room for exercise of judgment—it is scrap without doubt or discussion.

Incidentally, these general observations draw attention to a view of casting inspection not often considered; that is, that the total scrap resulting on one part number should be analysed for the various reasons for rejection. Then the cause for the greatest proportion of scrap can be investigated first. Ultimately, then, in most castings there is one type of inspection that finds the biggest part of the scrap, and on this examination a casting is shown to be acceptable or not. When this condition of production has been reached, quality control can be applied.

In the recent booklet[2] published by the Ministry of Supply, reference is made to a method of control of fraction defective using Go, Not-go gauges. By gauging, machined components are accepted or rejected without measurement, and the method is, therefore, comparable in result to a method of castings inspection without actual measurement of any value. This view is confirmed in an example in the booklet citing the inspection of a pressing having two critical dimensions, inaccuracy on either causing rejection. It is, in other words, quite simply accepted or rejected.

Example of Application of Method

It was decided to ascertain if the method could be applied to castings inspection. Records were to hand of pressure tests on many thousand die-castings. In spite of a pre-production stage, a great deal of trouble was experienced in production in obtaining pressure tightness. A comparatively minor modification to the die resulted, however, in a great improvement, until examination of the results over a period of six weeks showed that rejections due to lack of pressure tightness was 3.5 per cent. Although this result was gratifying, it was realised that such an isolated determination of percentage rejects did not give any information of the actual distribution of the rejects. Knowledge of distribution could only be obtained by a statistical method, which was consequently applied as an experiment to the available data.

One-quarter of the results was sampled, using samples of 20 individuals. The number of defectives in the first 20 samples were as follow:—

Sample No. ..	1	2	3	4	5	6	7	8	9	10
Defectives ..	0	2	1	4	0	3	0	1	0	0
Sample No. ..	11	12	13	14	15	16	17	18	19	20
Defectives ..	0	0	1	3	0	0	0	1	0	0

The total number of defectives in 20 samples is, therefore, 16, and, bearing in mind that 20 samples are the same as 400 castings, the percentage defective is equal to 4.

Now for any given value of percentage defective; there is a number of defectives that can be tolerated in any one sample. This number varies with number of individuals in a sample and percentage defectives, and is found from a table given in the Ministry of Supply handbook. In this case, this probability level

was found to be 3, which, practically, "is the number of defective components per sample which is to be taken as a warning of a possible deterioration in quality."[3] A control chart was plotted, and is reproduced in Fig. 1.

It will be seen that the number of defectives in each batch are plotted against sample numbers. A line representing the probability line was drawn on the chart parallel to a line representing zero defectives. The distribution of points is instructive. The first 20 samples were used as shown above to determine the percentage defective and for this degree of efficiency of production the probability line was fixed at 3. Since the handbook states that not more than one point in ten should come on or above this line, it will be seen that the production was not, in fact, in control at 4 per cent. defective. From sample 15 onwards this requirement is seen to be satisfied, and the manufacturing process may be said to be in control with a general process average of 4 per cent. defective.

As a matter of fact, if the results of samples 15 to 35 had been used to calculate percentage defectives and probability factor, the statistical data would have different values. It is true to say, however, that production is now in control at 4 per cent. defectives and, providing points fall within the control lines, released castings can be guaranteed to contain not more than 3 per cent. defectives with 25 per cent. inspection. The control chart shows clearly that an improvement in manufacturing efficiency was achieved.

The control chart represents inspection on castings representative of 6,400 components. It is necessary to maintain continuous observation by daily plotting on the chart to ensure that production efficiency remains constant. The emergence of two consecutive points on or above the probability line means that the standard of production has fallen and the cause should be immediately investigated. Such a control chart, then, provides a picture of production with the hitherto unknown means of guaranteeing that scrap is above a certain figure. It should be emphasised that this may be done with 25 per cent. inspection, that is to say, inspection labour may be economised.

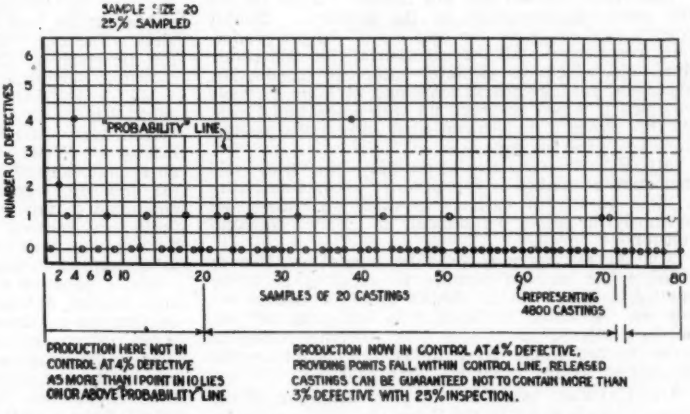

FIG. 1.—PRESSURE TEST RESULTS OF ALUMINIUM ALLOY CASTINGS.

General Conclusions

The method of control described can only be applied to orders of large quantities. There are many aspects of inspection to which this form of control can be applied. It would appear that such a system should be the basis for the granting of a concession on radiography, for the normal method of stating an inspection concession is rather vague; for instance, castings may be radiographed in the proportion of 20 per cent. of the production based upon the inspector's knowledge of consistency of the foundry's records, but no one can be sure that the remaining 80 per cent. unexamined does not contain an excessive number of scrap castings. If 20 per cent. was examined according to the system described, the maximum degree of scrap would be definitely known.

The method seems to have great practical value and brings to the difficult subject of light alloy casting inspection a degree of certainty which was previously only associated with machine-shop work. It is hoped that statistical quality control will receive more attention from foundry inspectors, and that the results of the experience will be published for the general benefit of the foundry industry.

Acknowledgment.—The Author would like to express his sincere thanks to the directors of Magnal Products, Limited, for their permission to publish this Paper.

DISCUSSION

MR. A. J. ROSTRON asked whether under the system of control described, did he understand that the customer was to accept 4 per cent. rejects?

MR. ALLEN, in reply, said that under A.I.D. inspection, and he supposed the inspection of any other purchasing Ministry, 100 per cent. inspection was the policy, and was, in fact, expected, but foundrymen must not insist that after they had taken every precaution during inspection, some rejects did not come back to the foundries. It would be a more satisfactory state of affairs if one could say to the customer, "Yes, you will find some rejects, but we can guarantee that they will not rise above a certain amount." It might

Statistical Quality Control Inspection

be difficult to convince a customer of the reason for that, but nevertheless this method had been accepted by the A.I.D., and one casting was released upon the terms that not more than 3 per cent. rejects would be found in deliveries. The Author's firm should give that guarantee, because it kept the control chart up to date. The real answer was that it meant that the customer was asked to accept some rejects, but the supplier could do it with a definite guarantee that rejects would not rise above a certain level, providing all the time that the manufacturing process remained stable.

MR. HAYWARD asked whether it was not necessary to have this inspection in the foundry itself?

MR. ALLEN replied that this method did not cut out the pre-production work in the foundry. Quality control methods made the best use of the pre-production work: it gave all the means available and conditions on which to achieve successful production. Successful castings production could be more certainly obtained if it was followed up with inspection charts. By this means it was shown what success the production was experiencing.

MR. E. POTTS, referring to the size of the order, said that quite a number of foundries were concerned with a large variety of castings in small quantities, and obviously it would be difficult to apply statistical control.

MR. ALLEN, agreeing, said he would not like to estimate the smallest number to which it could be applied, as much would depend upon the size of the job, etc. It could be applied to quantities of 200, but he preferred not to give it as a definite ruling, as many factors would have to be considered in the application to any order less than 1,000 off.

MR. HAYWARD asked for an exact definition of the figure of three given in the Paper.

MR. ALLEN said this figure was purely specific to this Part No. The 3 per cent. which could be guaranteed not to be exceeded on this casting was arrived at by the arithmetic of the result of those first 20 samples of castings. Some castings might give much less scrap than that, and therefore the process efficiency level would be more efficient; it might be much higher, and if a firm wished to apply this for approval inspection routine it would be necessary to ask the A.I.D. what they considered to be reasonable. He mentioned three because it was the figure that resulted from the original arithmetic. The figure three was the maximum number he expected in the majority of samples of 20 castings taken for test.

MR. HAYWARD presumed the Author was not eliminating scrap, and that he was only guaranteeing good castings.

MR. ALLEN said that in order to get the most efficient production one went to much trouble before any job went to the foundry for production. The foundry industry was such that many variables operated and scrap was produced, but if a foundry was producing castings with a reasonable standard of efficiency, shown by any inspection method, then one could apply this statistical control. Certainly the first thing to do was to produce the job satisfactorily in large numbers. This was the sequel to the hard spade work put in by the foundry technicians, it was done by the inspection and provided an indication that success was achieved.

MR. BRACE asked whether statistical control could be applied to arrive at a minimum specification of, say, ultimate tensile strength in test-bar results.

MR. ALLEN said that those who were going to use an alloy ought to know what strength they could confidently expect from the test-bars. He agreed that the way to arrive at the value was by means of statistical analysis of results, but many thousand results were required.

MR. BRACE asked how soon could falling off efficiency be detected.

MR. ALLEN said that it could be detected immediately. The only time lag consisted of the time taken for the result of the sample under test to be transmitted to the inspection office and plotted.

MR. J. H. GALE asked whether the foundry was controlled.

MR. ALLEN said the answer was largely the same as that given to Mr. Hayward. As a matter of course all foundry supervision would take as much care that the job was started correctly. The question really amounted to this. At what stage of foundry process should the method be applied? and his answer was "As soon as possible," but the object, of course, was to economise in inspection.

MR. J. MORGAN asked whether it would be possible, once the job had settled down, to alter the limit and so alter the guarantee figure subsequently.

MR. ALLEN pointed out that his line was calculated on 20 samples. One could achieve the modification by the two methods of increasing the sample size and recalculating the limit when production had settled down. Mr. Morgan was quite correct; the guarantee figure could be reduced if production became more efficient as production proceeds.

MR. J. W. GARDOM (president of the Institute) said he had listened with very great interest to the Paper, for he was a great believer in quality control methods. His opinion was that they would be used to a great extent in foundries in the post-war period.

REFERENCES

[1] A Method of Correlating Foundry Practice and Quality of Light Alloy Castings, H .G. Warrington. *Proceedings of the Institute of British Foundrymen*, vol. 36, 1942–1943.

[2] Statistical Control—An Account of an Attempt at Application in a Light Alloy Foundry, F. A. Allen and P. R. C. Pyle. FOUNDRY TRADE JOURNAL, September 16, 1943.

[3] A First Guide to Quality Control for Engineers, 1943. Ministry of Supply.

J. F. Noseworthy & Son (Pty.), Limited, of Cape Town, have just completed a contract for the supply of a complete plant for a fish canning factory.

The 26th National Metal Congress, organised by American Society of Metals, American Welding Society, American Institute of Mining and Metallurgical Engineers, and other technical bodies, attracted over 30,000 visitors when it met at Cleveland in October.

THE PRODUCTION AND FOUNDING OF INOCULATED HIGH-DUTY CAST IRON

Co-operation of the designing, pattern-making, founding and metallurgical departments

By J. L. FRANCIS, A.M.I.Mech.E.

(*Continued from page* 341.)

Benefits of Inoculation

By means of inoculation a control of the structure of both graphite and matrix can be obtained such as is not possible by the adjustment of chemical composition alone. Indeed, in many cases marked changes are effected in structure and mechanical properties with very slight alteration of the chemical analysis. Herein lies the difference between ladle inoculation and ordinary alloying of grey iron. Each process is capable of augmenting the other so that inoculated irons can be improved by judicious alloying, and most alloyed irons can be improved by inoculation. Change in properties resulting from the introduction of alloying elements is due to their direct effect on the carbon or rate and temperature of transformation of the structural changes. These depend on the amount of the element present, but not so with inoculation where analysis forms no measure of the effect of the inoculant. Often chemical composition does not reveal whether inoculation has been used or not.

Cast iron with high mechanical properties can be readily and consistently produced by the inoculation of low-carbon equivalent charges when molten in the ladle. Without any other treatment or additions tensile strengths up to 20 tons per sq. in. are readily obtained, and the addition of alloys such as nickel, molybdenum, etc., will raise this value to as high as 28 tons per sq. in. The machinability of such irons is better than that of uninoculated iron of the same hardness. Most important for pressure castings is the reduction of section sensitivity whereby it is possible to obtain uniform closeness of grain and density throughout all wall thicknesses, and less tendency towards chilling of thin sections and sharp edges. There is also less variation in mechanical properties and it appears for these low-carbon irons that a change in silicon content of one or two points has far less effect.

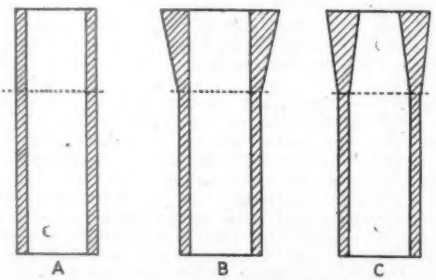

FIG. 8.—FEEDER HEADS FOR LINER CASTINGS.

Shrinkage on Solidification

At this stage some of the basic principles involved in the founding of high-duty cast iron will be considered. All liquids, in passing from a higher to a lower temperature contract in volume. Cast iron approaching solidification is no exception, although from a theoretical standpoint the volume contraction is neutralised to some extent by the extra space taken up by the graphite when it forms from the solution of carbon in iron as the alloy freezes. A grey-iron casting, shortly after pouring, consists of four things: (1) the crystals of austenite; (2) liquid of similar composition; (3) solid graphite, and (4) the liquid phosphorus eutectic. Due to separation of some graphite an expansion has occurred, but it has taken place while a large portion of the casting is still liquid. Shrinkage of the solidifying liquid still takes place, and its volume becomes too small to fill all the space inside the solidified skin of the casting. Thus, unless extra liquid iron is supplied, the casting contains a shrinkage defect. Where the rate of solidification varies greatly from one place to another in any one casting, the defect will be located at the heaviest part or at the last portion to solidify. On the other hand, where setting occurs more uniformly, the shrinkage will be distributed more evenly, and may take the form of finely divided general porosity.

Pearlitic matrix irons have about 0.85 per cent. of the total carbon in the combined form, the rest is deposited as graphite. Therefore, the lower the total carbon the smaller the quantity of graphite in the structure. Low graphite content makes for higher strength, but when the total carbon is in the region of 2.5 per cent. or less, shrinkage troubles become very pronounced, and considerations of strength are dominated by those of soundness. Consequently, total carbon is regulated to the approximate limits of 2.8 to 3.2 per cent. Irons within this range have the highest strength which can be obtained in straight grey compositions without special additions of treatment, and it extends from 18 to 22 tons per sq. in. When pouring castings from these irons their higher solidification shrinkage must be allowed for by using adequate runners and headers of the self-feeding type, as rod

feeding is of little use and not applicable due to the shortened freezing range.

Fluid shrinkage does not vary greatly with the composition of the iron, but depends more on the temperature of the metal at the time of pouring. With normal sand moulding practice average values are about 1.0 per cent. for soft irons and 2.5 per cent. for close-grained cylinder irons.

Progressive Solidification

If a casting could be made to solidify simultaneously in all parts, no draws or shrinkage cavities would develop. It is possible to pour a mould with metal of no freezing range, which therefore solidifies at a definite temperature, but that temperature will not be reached at the same time in all parts of the mould.

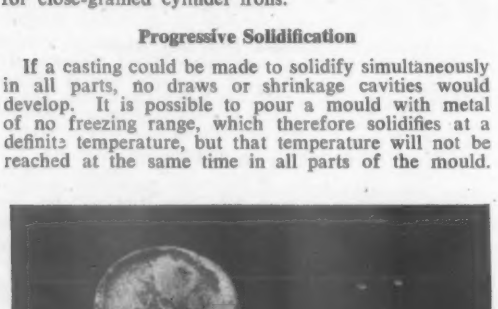

FIG. 9.—COUPLING CASTING WITH PENCIL GATE RUNNING SYSTEM.

The more complex the casting and the greater the variation in its sectional thickness, the larger will the divergence from instantaneous solidification become. Immediately delayed solidification takes place, the conditions causing shrinkage, draws, porosity, and other kindred defects are set up. There is, therefore, no hope of eliminating this hazard, it is only possible to take steps calculated to reduce its effect.

Efforts in this direction are chiefly concerned with progressive or directional solidification, which means that the temperature gradient of the metal should slope uniformly from the place where the iron first comes to rest to a maximum at the position it occupies last. Design often makes it impossible to attain the ideal, but much can be done by gating into thin sections and using denseners to speed up the cooling of thick ones.

Runners, Risers and Feeding Heads

There are, of course, many other causes of waster castings apart from shrinkage defects, and it is hardly necessary to point out that no metal or alloy, however good it may be, can be formed into a good casting if the moulding, coremaking or other allied practices are not properly carried out. Runners and ingates should be truly in line with the casting sections entered, so that metal does not impinge on the mould or core surface at the point of entry. Ingates on circular flanges should be tangential. Observance of these rules will eliminate scabs and reduce turbulence, which tends towards unsoundness. Many points which are important if sound castings are to be produced are obvious, but often neglected. All runners and gates should be part of the pattern and as carefully rammed up as the mould cavity itself. Too small gates may cause a misrun, whilst too large ones may bleed the casting. The sand of which the pouring basin is composed should receive the same care and treatment as the facing sand which lies against the pattern.

All castings need a runner, but all do not need risers. Moreover, although a riser often functions as a feeding head, it is not necessarily the same thing. It is a convenience to have indication when a large mould is filled, and in a cored mould of any considerable size one or more risers should be provided to give an outlet for gas bubbles. Such risers should be in position where gas is likely to accumulate and on the highest points of the mould. When a core or upstanding part of a mould is covered with metal, gas pressure inside tends to rise quickly. If a core continues to blow when a head of metal of 12 in. is above it, the gas pressure inside the core is greater than 3 lbs. per sq. in. A few inches increase in height of runner and riser heads can give just the extra pressure necessary to force the gases out by the vents provided.

Fig. 7 illustrates some faults commonly made with feeding heads. These are all heads of circular section. In example "A" the area of contact with the casting is too small and the reservoir for holding the molten metal is too small also. Even if it were larger, the small neck would freeze before feeding could be completed. With "B," the head is not of the right shape to maintain the metal liquid for a long enough time. Feeding head "C" is of the right size and shape, but the neck is too long and in consequence would set too quickly and prevent further feeding action from taking place. The correct method of applying a feeder is shown at "D." Here the surface to be fed is amply covered, enough liquid metal is contained in the head to meet the demands of the shrinkage, and the short neck will not set and cut off the feeding action.

Both wrong and right methods of applying feeding heads to liner castings are shown in Fig. 8. They are of the self-feeding type. "A" is of the same section as the casting and cools at the same rate. Its extra metal is therefore not liquid long enough to give efficient feeding, and is effective only as a sullage piece. Head "B" holds more metal and maintains it liquid after the thinner section below has set, so that it is

available for counteracting liquid shrinkage taking place lower down. Theoretically, head "C" gives the maximum self-feeding effect because its centre line coincides with that of the liner wall.

In practice, head "B" has been found to give good results, in conjunction with equally spaced top gates, giving an equal distribution of hot metal and ensuring that finally the hottest iron is in the feeding head, causing progressive solidification from the bottom upwards. Top pouring also keeps the surface of the rising metal in a state of agitation until the mould is full, thereby helping to prevent dirt or scum from remaining attached to the mould or core walls and assisting its journey to the top. The heads are about one-quarter to one-third the length of the liner, and flared to give an average thickness of twice that of the wall.

Well-formed and suitably placed feeding heads can ensure soundness over quite a large volume of casting. Rod feeding is not applicable to many cases when using high-duty low-carbon irons. It is not recommended because of the short freezing range which may result in partially solid material from the head getting pushed down into an important surface underneath, or the grain of the metal may be disturbed and dragged about beyond recovery. Self-feeding heads of the type described will work quite efficiently and their effectiveness may be increased by the application of a heat-generating flux to the molten surface, which increases the fluidity of the metal in the head and maintains it liquid over a longer period of time.

Pouring Temperature and Speed

Emphasis is again placed on the necessity for pouring high-duty irons as hot as possible. A temperature of between 1,350 to 1,400 deg. C. should be used. Melting zone temperature in the cupola is of the order of 1,650 deg. C., but during its passage through the coke bed the metal loses heat and a tapping temperature of 1.400 deg. C. is about as high as may be expected. High pouring temperature helps to eliminate shrinkage defects, although liquid shrinkage is greater the higher the casting temperature. The hotter a cupola-melted iron is poured, the quicker and more uniformly it cools through the freezing range. Before solidification commences, the surrounding sand of mould and cores becomes heated and tends to equalise the cooling speed throughout the casting. Actually, the mass of sand acts in the capacity of a heat accumulator, assisting natural feeding and reducing casting strains.

Speed of pouring, too, plays an important part in obtaining sound castings. Experience is essential in gauging this satisfactorily, since more factors than one are involved. The pencil-type runner publicised by Ronceray aims at a speed of pouring sufficiently slow so that most of the liquid shrinkage occurs during the time the mould is filling. Strainer core pouring is an adaptation of this principle. For these methods of running, hot metal is essential, and they are applicable mainly to lumpy castings of simple design and without much coring. Heavy coupling castings are poured through pencil gates with great success, and the strainer core method has been applied to flywheels run directly on to the boss, which is cast solid. Fig. 9 shows the coupling mentioned and the three pencil gates used in running it. No centre core is used and the amount of liquid shrinkage which occurred after the mould was cast can be seen from the sink in the extended solid boss. When bored out, these couplings show perfectly sound and dense, and the same applies to flywheels cast with strainer cores.

Hot Spots

Hot spots are a frequent cause of leakage in pressure castings and the trouble is often wrongly attributed to shrinkage porosity. Any factor tending to maintain metal fluid in a mould at various odd places after the bulk has become solid, is a potential source

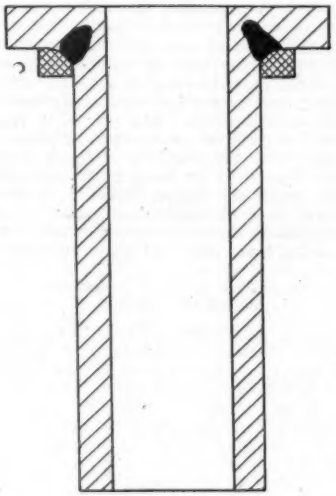

FIG. 10.—HOT SPOT DEFECTS IN A FLANGED CASTING.

of defects. One such factor arises when portions of the mould become excessively heated, forming "hot spots." Sand walls of little thickness may separate two heavier walls of metal, and small cores and projections are often nearly completely surrounded when the mould is cast. Prolonged passage of metal past a given point can have the same effect of raising the sand to a temperature approaching that of the molten iron itself.

Once part of the sand forming a mould or core has become so heated it not only greatly retards cooling of the metal adjacent, but most likely itself evolves gas which, finding no other exit, remains trapped in the casting. The sponginess, porosity, or holes revealed on machining are due entirely to the sequence of events forming the "hot spot."

Inoculated High-duty Cast Iron

Replacement of the sand by a densener, at the point where the hot spot occurs, removes the cause of the trouble. Ribs and webs where they adjoin the body of a casting, often mark an area of porosity generally ascribed to drawing away of the liquid metal. When the cross sections involved are disproportionate the cause mentioned may be correct, but the defect occurs where sections are uniform and not excessive. At rib junctures there invariably exists a wedge of sand heated from several sides, and, in consequence, more fiercely. Avoidance of the rib, or more rapid cooling at the junction eliminates the sponginess, whereas extra feeding will not do so.

Another instance of the hot spot defect occurs where two cylinder bores come close to each other. It is also developed by moulding castings such as liners or bushes too near to one another in the same box. An unsuspected cause of the defect follows the placing of a down runner too near the casting. In all these cases, the sand may be heated strongly enough to retard cooling, and evolve gas which is forced into the metal during solidification. The use of a very open sand and well venting at these congested places greatly assists to overcome the trouble. Flanged castings as illustrated in Fig. 10 often weep under hydraulic test, at the radius under the flange, especially if the recess made to take the bolt heads cuts into the fillet. A densener applied as shown is a sure remedy, or a well dried and vented loam cake will prove effective.

Design of Castings

The preceding paragraphs of this Paper have dealt to some extent with the production of high-quality metal, and how to overcome some of the troubles experienced in founding it, all of which aims at avoiding making defective castings. Much of these precautionary measures can, however, be counteracted by castings badly designed from the founding point of view. Even if such castings are eventually made successfully they are a serious handicap and increase production costs.

Often a modification to the pattern which has no effect whatever on the utility of the casting will greatly increase the chances of obtaining a sound job and dispense with much trouble and scheming in the foundry. If a thickened section is liable to contain a hidden defect it may not be stronger but weaker than the other parts of the casting. In any case, it is not proportionately stronger because cooling is retarded, with consequent increase in grain size. These influences offset the theoretical benefits shown from the calculations of the designer, who thickens sections to give a greater factor of safety.

Warping of castings can also be attributed to extremes of section thickness. Indeed, the stresses so imposed by differential cooling become so large occasionally as to cause severing or cracking of the parts. Hence design as applied to sectional thicknesses, changes, and the radius of fillets is of the utmost importance, apart from considerations of ease and economy of production.

Coring is also a subject not always fully understood or appreciated by the designing staff. All holes and spaces in castings have to be formed by sand cores or equivalent projections from the mould surface. Wherever a core is used, provision must be made to hold it securely in place, vents must be taken off from it to the outside of the mould, and it must be removable after the casting is made. Besides all this, the manufacture of cores is a charge on the job. Therefore, although cores reduce the weight of a casting they do not necessarily lessen its cost of production. Re-entrant cores, by extending the sand surface into the heart of a casting, may set up the "hot spot" type of defect already mentioned.

From the foregoing it is seen that nothing less than wholehearted co-operation of the designing, pattern-making, founding and metallurgical departments is needed if waste of time and misplaced effort on the part of all concerned is to be prevented. Foundrymen often attempt the production of a casting which they know from experience will lack soundness rather than have doubt cast on their skill or ability. General sympathetic consideration of the difficulties of all concerned will help tremendously to smooth the path and further mutual interests.

Acknowledgments

Finally, it is desired to record appreciation to the authors whose works have been freely quoted. Also to thank the Institute of British Foundrymen for loaning some of the slides and Mr. R. Boddey for preparation of the photomicrographs and the remaining slides. The Author is also indebted to the directors of Foundry Services, Limited, for the permission and facilities granted, without which the presentation of this Paper would not have been possible.

TELLURIUM IN CAST IRON

The last issue of "The Foundry" to reach this country carries an article on this subject by Mr. John S. Crout, of the Battelle Memorial Institute. In it he reviews recent work by Smalley and by Lorig and Krause. Tellurium is now established as the most powerful chill-throwing element so far discovered. In some of the experiments described, tellurium was added by painting chills on the mould surface. Only a very small quantity is needed to give remarkable chilling effects—something of the order of 0.001 to 0.05 per cent. The chilled portion is said to show enhanced acid resisting qualities. The cost of using tellurium is reported as being about 1s. 3d. per ton of iron treated, the price of tellurium being about 8s. 9d. per lb.

The Board of Trade announce that they are now issuing licences for the manufacture and supply of aluminium hollow-ware by any manufacturers who can make capacity and labour available now for this production without detriment to war work on which they are engaged. Details from Neville House, Page Street, London, S.W.1.

AIR HOISTS

For many handling problems the straight lift air hoist or ram has no equal either in its low initial cost, its low air consumption, or in its capacity to withstand rough usage. The design comprises a cylinder (either cast or of weldless steel tube accurately bored) in which a piston carrying a piston rod is inserted, the latter acting as the lifting medium or as a ram. The piston has a cup leather to prevent air passing between the piston and cylinder.

In its simplest form air under pressure is admitted beneath the piston which immediately moves vertically or horizontally, taking with it the load attached to the end of the piston rod. The capacity of such a hoist depends upon the area open to air pressure (*i.e.*, the area of the cylinder less the area of the piston rod) and the pressure at which air is admitted, an allowance being made for friction loss. The average 2-in. dia. cylinder working under normal air pressure of 80 lbs. per sq. in. will deal with a load of about 2 cwts., whilst the average 3 and 4-in. cylinders handle loads of 3 and 7 cwts. respectively.

To enable the load to be lowered it is only necessary to exhaust the air from beneath the piston when the load will return to its original position, the weight forcing the air from the cylinder through the exhaust port of the operating valve.

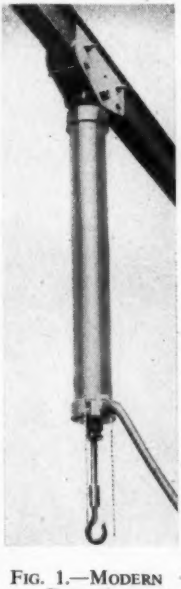

FIG. 1.—MODERN DESIGN OF AIR HOIST.

Single Acting Type

The foregoing description relates to the single acting type in which the load is raised by the inlet of air (through the operation valve), and lowered by exhausting air from beneath the piston, the weight of the load itself acting as the force ejecting the air through the exhaust ports of the valve, the latter having first been put by the operator in the "lowering" position. The capacity and speed of operation naturally depend upon the available air pressure, size of cylinder and the sizes of the inlet and exhaust ports in the operating valve.

Where loads are required to be lifted for a very short while, transported to another position and then dropped, this type of appliance is ideal as it meets the requirements of low initial cost, low working cost, and a total absence of intricate working parts to go wrong. The type, however, suffers from the disadvantage that the load cannot be left in its raised position indefinitely, as there will in the best machine be a slight leakage of air past the cylinder or through the ports of the control valve. This disadvantage does not exist, however, when using the hoist in foundries, as the load is not needed to be sustained in the lifted position for any extensive period. This equally applies when lifting and lowering loads over degreasing tanks where the operator can stand well away from the whole apparatus and control the lowering of the parts into the tank.

Other Types

Apart from the single acting type of straight lift hoist dealt with above the same machine is made in double acting, balanced and trip acting. In the double acting type the piston does not return to its original position under the weight of the object being handled, but is lowered under air pressure on the upper side of the piston, *i.e.*, the lowering is made like the lifting, under air pressure. This type is used where a user for some reason desires to control the lowering speed, or where the piston has to be returned to its original position, but there is no weight to perform the task (as would happen in the case of the horizontal ram).

The balanced type is an adaptation of the single acting type. Whilst air is entering below the piston at mains pressure the air above the piston is exhausted through the valve at a pressure above atmospheric. As a consequence there is a high pressure below the piston acting against a lower pressure above the piston. The action, therefore, is one of extreme "ease," and the load can be manipulated quickly or slowly at will. This type is eminently suitable where it is desired to withdraw patterns from moulds. In such cases the initial pressure is high, but when the load is released from the mould a tendency exists for the sudden release of the load to cause the piston to rise very quickly with possible damage to the cylinder head. By using the balanced type there is adequate back pressure on the upper side of the piston to act as a cushion and prevent the piston rising sharply.

The next adaption of the single acting type is the trip. In this design the load is raised and lowered as in the single acting, but an arrangement is fitted at the side of the hoist so that when the trip rod attached to the piston rod reaches its predetermined position in the upward or downward stroke a finger operates the valve. By this means the hoist can be left in operation for as long as there is air in the mains, and there is no need for human intervention except to start or stop the apparatus. Trip hoists are very often found in hardening shops, where it is necessary continually to immerse parts in a cooling or hardening tank, but the parts must not be allowed to remain stationary.

The general appearance of a modern design of air hoist is shown in Fig: 1, which illustrates a type made by the Consolidated Pneumatic Tool Company, Limited, of 232, Dawes Road, London, S.W.6.

Lieut. J. D. Thom, R.N.V.R., who has been awarded a Bar to the Distinguished Service Cross for gallantry in Normandy in November, had completed, before the war, his apprenticeship in his father's firm of Thom, Lamont & Company, Limited, engineers and pump makers, Paisley.

RELIEFS IN CONNECTION WITH SCIENTIFIC RESEARCH

NEW PROVISIONS EXPLAINED

By F. J. TEBBUTT

In connection with certain concessions in the Finance Act, 1944, as regards scientific research, as regards income-tax, it should be remembered that this term by the general definition means any activities in the fields of natural or applied science for the extension of knowledge, and as regards a trade (or class of trades) includes any scientific research which may lead to or facilitate an extension of that trade or trades, and also applies as regards any medical research relating to the welfare of the employees of that trade or trades; therefore this short article may be useful to most readers, especially as capital expenditure is deductible from profits for income-tax, expenditure not usually deductible in income-tax law.

Capital and Other Expenditure

Whether scientific research related to a trade is undertaken by the trader or on his behalf, any expenditure under this head, not of a capital nature, is deductible as a trading expense. Moreover, any sum, whether of a capital nature or otherwise, paid to any association which undertakes research in relation to the trade concerned is similarly deductible, and this also applies as regards any sum paid to be used for such research, to any university, college, research institute or other similar institution. The association or university, however, must be approved by the Committee of the Privy Council for Scientific and Industrial Research, or by the Medical or Agricultural Research Council formed under the appropriate research committee of the Privy Council. Arising out of this provision, such things as salaries, costs of materials, repairs, subscriptions and so forth, will be deductible as trading expenses as and when incurred. It might be of interest to note that by administrative action annual subscriptions to trade associations undertaking scientific research have in some cases been allowed, but in no case have sums paid for a capital project been deductible. This new provision now gives statutory effect to the first-named matter and allows any payment coming in the last-named category.

For purely capital expenditure on scientific research, the set-off against profits is made somewhat differently, as, although the expenditure will be allowed, the amount cannot be deducted all at once. The allowance off profits will be spread over five years of assessment, that is, one-fifth will be deductible for each of the appropriate five years. By this new provision capital expenditure on such things as laboratory buildings, plant and machinery and so forth will be deductible from profits.

It should be noted that the provision applies whether the research is directly undertaken by the concern in question or on its behalf, and the deduction procedure not only applies to expenditure by existing firms on scientific research, but also applies where expenditure on scientific research is incurred and a business afterwards commenced connected with that research.

Items of Substance

A point to note is that, while the appointed day for these provisions to operate has yet to be published, the Chancellor of the Exchequer has stated that any expenditure coming within these research provisions incurred before the appointed day will nevertheless apply as a deduction, as if incurred after that date, this meaning that amounts actually expended will attract the concession, but it may be added that any amount just set aside to be expended on scientific research later on will not be deductible until actually expended.

In conclusion, although the provisions in the Finance Act, 1944, only refer to income-tax, it has been officially stated that somewhat similar provisions will eventually apply (that is, with necessary modifications) to excess profits tax. This tax, broadly speaking, is, of course, assessed on income-tax principles.

BRITISH ENGINEERS' ASSOCIATION

At the annual general meeting of the British Engineers' Association, held in London last month, resolutions were adopted unanimously confirming the arrangements which had been made for the linking-up of the sectional trade associations with the B.E.A., and for their representation on its governing Council. It had been decided previously that membership of the B.E.A. should be open to sectional trade associations whose members are mainly concerned with the mechanical engineering industry. During the past year some 20 sectional trade associations have been working in collaboration with each other through the B.E.A. as a focal centre and, with the largely increased membership of individual manufacturers, the work of the Association has grown extensively.

The Director of the Association, Mr. A. W. Berry, M.I.E.E., referred to the close contacts maintained by the Association with the appropriate Government departments. He referred to the work of many Committees serving in the interests of the industry as a whole and to the importance of co-operative effort in securing the re-establishment of post-war export markets.

The result of a ballot for vacant seats on the Council in the ensuing year was announced. The Hon. J. K. Weir, managing director of G. & J. Weir, Limited, was elected as the new member of the Council.

At the subsequent Council meeting, the President, Mr. Cecil Bentham, M.Inst.C.E., M.I.Mech.E., M.Inst.T., was re-elected President of the Association. Lt.-Col. H. B. Riggall, assistant managing director of Ruston & Hornsby, Limited, and Mr. C. K. F. Hague, deputy managing director of Babcock & Wilcox, Limited, were elected vice-presidents.

SAVE STILL MORE PAPER

MECHANICAL AIDS TO CORE PRODUCTION

WEST RIDING BRANCH DISCUSSION

At the opening meeting of the new session of the West Riding of Yorkshire Branch of the Institute of British Foundrymen, on October 14, following delivery of the Presidential Address by Mr. J. Blakiston, A.I.Mech.E., M.I.P.E., of Halifax, Mr. Blakiston gave a *résumé*—illustrated by lantern slides—of his Paper* "Mechanical Aids to Core Production," which had been given earlier in the year to the East Midlands Branch and which secured for him the award of a Diploma of the Institute.

Dimensional Inaccuracies of Chaplets

Opening the discussion, the CHAIRMAN (Mr. J. Timbrell, Senior Vice-President) said, whilst much of the costly modern mechanical equipment available to the foundry industry was really only practicable in the larger or specialised establishments, there was much cheap mechanical aid which could quite well be applied to the average jobbing foundry. The core conveyor was a service, for instance, as it cut out much laborious work. He was rather surprised at Mr. Blakiston's reference to chaplets having such an apparently wide divergence from strict accuracy in size. He, personally, had used various sizes of chaplets up to as much as 2½ in., and had experienced but little trouble. It would seem there must be some chaplets supplied to more accurate dimensions than Mr. Blakiston seemed to have encountered.

MR. BLAKISTON remarked that whilst the chaplet in itself might only be a fraction of an inch out of truth, yet if there were three or four cores in a mould with a chaplet sandwiched between each of them, it would be found that the small inaccuracy could become very considerable in the bulk.

MR. WOOD said, as a chaplet maker, he agreed there existed a liability to error, but the makers were getting to finer dimensions of accuracy, as the industry warranted it. When he first went into chaplet making 15 years ago, it was a case of measuring with a blind rule—the same as the moulder does—formerly made by a blacksmith or wheelwright, but in modern chaplet making specifications are now definitely laid down to a thousandth of an inch, especially when making for the motor-car industry. Mr. Wood agreed, however, that there was still scope for more accuracy, especially in the larger sizes. If members interested were ever in Halifax and would care to visit his works, he would be glad to show them work which, he thought, would discredit any suggestion of widespread general inaccuracy of chaplets.

MR. BLAKISTON said his remarks were intended more as an indication of trends against which the foundryman must be on the alert. He had no doubt the modern chaplet maker could get down to an accuracy if given specified instructions of what was required. All he wanted to emphasise was that the foundryman himself must be as particular in this respect as he was expected to be in other factors of the job.

Fuel for Core Stoves

MR. H. FORREST inquired whether Mr. Blakiston had ever considered the relative merits of gas-firing as against coal- or coke-firing for core stoves from the point of view of temperature control.

MR. BLAKISTON replied that he had done some experiments himself and had seen others. He found the vertical stove extremely economical in fuel consumption, which was ridiculously small, but there was a tendency to irregularity in the chart markings. On a stove fired with producer gas he found the chart had practically a straight line. For anyone in an area with cheap coal gas, or who had producer gas on the works, he would advocate gas-firing.

Core-blowing Machines

In answer to Mr. F. K. Neath, B.Sc., MR. BLAKISTON said he had not had personal experience of core-blowing machines, but had seen several in operation; his impression was such that he would not say they were particularly suitable to jobbing work. On account of each corebox being of different shape, etc., it took so long to arrive at the correct disposition of the core vents, but for repetition production he would state the core-blowing machine was well worth consideration.

In answer to a query by Mr. Neath as to whether he thought there was a tendency to sagging of the cores due to vibration in the vertical stove, MR. BLAKISTON felt that, if the sand were properly mixed, the danger of such sagging was minimised. It might perhaps be well to give it a chance to air dry or harden before placing in the stove.

Extent of Use of Mechanical Devices

MR. DOUGLAS JEPSON inquired to what extent were these various mechanical devices adopted or otherwise in the trade at present. One could readily appreciate their desirability; some were quite simple, and others seemed to require considerable capital outlay, and, perhaps, shortage of space also limited their adoption. He would like to know, therefore, the relative extents to which they were used in the trade.

MR. BLAKISTON said small devices like wire cutters and similar tools could be bought readily, but they had a marked tendency to vanish and must be looked after. On the other hand, if they were put out of sight, they were in danger of getting lost or going out of use. If these things were in a handy position and, perhaps, chained down to prevent their disappearance, they were there for constant use. Their general use seemed to be governed by their availability.

In reply to Mr. Jones in regard to the drying of cores, MR. BLAKISTON said he found they very rarely got burned if the blacking spraying was done properly. If the blacking spray was not worked correctly, there was a tendency to spray water only, which was detrimental to the cores.

Sand Dryers

MR. W. G. THORNTON said one thing on which Mr. Blakiston had not touched in his Paper was the sand

* F.T.J., May 18 and 25, 1944.

Mechanical Aids to Core Production

drier and what difference a dry sand had in the finished core as against a wet sand in the state usually received. Mr. Thornton considered the sand drier to be a very important component.

MR. BLAKISTON said he fully agreed that the sand drier was essential for correct core making. One must give a consistent moisture content and a drier was needed to maintain that consistency. Sea sand, of course, had a certain amount of moisture in it, and if there was too much, one must add dry sand. If one had to use a quantity of binder because of wet sand, it would be found very costly with present-day prices of core compounds.

At the request of Mr. Thornton, MR. BLAKISTON illustrated on the blackboard several methods of sand drying, including static and mechanical types.

Core Oven Temperature Control

In answer to a query by the CHAIRMAN (Mr. Timbrell) as to temperatures in the core stove for drying big and small cores mixed without risk of burning, MR. BLAKISTON said it was really very difficult to burn a core in the vertical stove. The temperature would be about 230 deg. C., varying a little according to the sand. Bulky cores were passed round twice. Asked as to his opinion of hand stoking as against automatic stoking, Mr. Blakiston said the only drawback—a very minor one—was that on a well-fired stove the foundryman expected to see his boxes come out nice and white in the morning, whereas with the automatic stoker they had a tendency to come out black.

Sandslinger for Core Making

MR. HAMMOND asked whether the lecturer would consider the application of the Sandslinger a suitable substitute for the jolter or turnover machine for core making. Mr. Hammond asked also for the Author's opinion on the use of lighter materials—asbestos mixtures for instance, as core plates in place of cast iron or steel. Would he consider them as economic and effective in the foundry?

MR. BLAKISTON said personally he was in favour of cast-iron core plates as against steel because steel tends to get bent with constant use and handling, and with a bent plate there was an effect on the core. If a cast-iron plate was mishandled it broke rather than bent, and was therefore scrapped. For light core making asbestos sheets could be used with advantage, and had quite a long working life. On the question of the Sandslinger, that was rather a dear tool, and he thought the core-blowing machine had rather superseded it. He could hardly see that the capital cost and running cost of a Sandslinger was justified for core making. There might be a tendency for the core sand to stick a little, and it might therefore be expected to be troublesome. Of course, where there was a Sandslinger already available, and it was not in full production for moulding, it certainly should be tried out for core making, preferably for dry sand work.

MR. NEATH confirmed the statement that the light asbestos core plates had a marked advantage in the certainty that they would keep flat and they were light to handle and lasted quite a long time. They avoided any risk of bending the cores.

In answer to a question by Mr. Neath as to distortion in stoves—particularly drier shelves—by warpage of non-ferrous materials, MR. BLAKISTON suggested one should have a material of the lowest co-efficient of linear expansion, and in his own experience cast iron seemed to meet that need best. Mr. Blakiston added a personal feeling that distortion was perhaps due mainly to constant tapping or vibration of core plates in a particular place.

Vote of Thanks

MR. A. S. WORCESTER, proposing a vote of thanks, said the West Riding Branch had had a succession of excellent and able presidents, both scientific and practical. This year they were unusually fortunate in having at the head of Branch affairs a man who became a foundryman after being an engineer, and was, therefore, now an example of a happy and most valuable combination of knowledge and experience on both the production and requirement side of founding. It was not a very frequent combination in one man, and the Branch was certain to benefit from it in the course of the session's discussions.

Mr. Hammond seconded, and Mr. Blakiston briefly responded.

BIRMID INDUSTRIES, LIMITED

A large gathering of the employees of the Birmid group of companies was present at the annual award of long-service certificates in the Smethwick works canteen, held just before Christmas. There were in all 48 recipients of certificates, bringing the number of people who have now served with one or other of the companies for 25 years to nearly 300—an impressive figure even among the 12,000 employed by the companies, and perhaps unsurpassed if one considers the comparatively small beginnings of the Birmid group. Directors as well as workpeople were among the recipients. Mr. H. J. Owen, who was works manager of the Birmingham Aluminium Casting (1903) Company, Limited, from its inception until his retirement in 1933, and who recently celebrated his 80th birthday, assisted in the presentation. During the proceedings, over which Mr. P. Pritchard presided, a cheque for £1,000 from the funds of the Birmal Club was handed to the Royal Cripples Hospital, Birmingham, for the endowment of two beds in the children's wards. Similar sums were given to the Alumidec Works Sickness and Accident Fund and the Alumidec Benevolent Fund.

The claim of the engineering trade unions for an increase of wages will be before the employers at a joint conference on January 18. It is five months since the National Committee of the A.E.U. decided to present a claim for an increase of 10s. a week and for an examination of the wage structure of the industry.

POWER TRUCKS FOR FOUNDRIES *

Among the many industries using power trucks few have greater need of their potential savings than the foundry industry. The modern foundry, producing steel, iron, malleable and alloy castings needed for munitions is equipped with high-rate production machinery. Such a plant should be equally well equipped in its handling system.

There is work for the power truck in conveying patterns, in the core room, and in feeding the foundry floor with moulding boxes, sand, and ladles of molten metal from the cupolas; in conveying castings from the foundry floor to the fettling shop, and thence to the various finishing processes and to the dispatch point.

Two examples may be quoted, the first being in the charging of malleable annealing furnaces. This was formerly carried out by means of hand trucks, specially built for the purpose, which handled annealing boxes in units of five. To charge the furnace 33 loads were needed; each load weighing approximately two tons. This meant that 66 tons had to be man-handled into the furnace, and then removed from it. The laborious task took an average of 16 man-hours. It was reduced to 1¼ man-hours on the introduction of a power truck.

In the second example, two power trucks in the core room affected appreciable savings over hand trucking of core-racks from the core-making machines to the baking ovens, and from the baking ovens to the cooling floor. After the cores had cooled, the trucks hauled the racks to the counters and inspectors, and the empty racks were returned to the core-making machines. Formerly there were eight hand-truckers employed in this department; after the installation of these two power trucks six men were released for other work. In addition to saving labour it was found that the power trucks also reduced core-breakage in the core room virtually to zero. As a result the two trucks have more than paid for themselves in their first year of service.

These two instances show how power trucks, applied to foundry uses, can successfully effect obvious economies. They are also invaluable for the speeding up of movement from the grinding department to the annealing room.

One material-handling problem overcome by an enterprising management's use of power trucks was in the steel and grey-iron foundry. The problem was concerned with the pouring of large castings, requiring more metal than can be hand shanked, as well as with the supply of metal to the more distant parts of the foundry floor.

It had been the practice here to convey the metal from the cupola in a 3,000-lb. ladle mounted on a narrow-gauge rail car that was pushed by hand on a track running along the middle of the floor, and was picked up and poured by an overhead crane. When tapping every seven minutes it was difficult to draw it and supply the moulder at an equal pace.

The hand haul between the cupola and the crane department, a distance of 150 ft., was the principal reason. It was noted that power trucks already in operation moved with the smoothness that a load of molten metal would require, so a power truck and a quantity of steel skid platforms were put into operation. Since then there has never been the slightest difficulty in supplying metal to the most distant parts of the foundry floor, nor has the liquid nature of the load itself proved to be a problem.

The ladles are simply picked up on skid platforms at the cupola and delivered to the overhead crane on the pouring floor, or set down within its reach. The truck is able to make the 150-ft. trip from the cupola to the heavy moulding department in 35 seconds, which is not more than half the best time made by the hand rail-car.

Man-hour savings can be quoted in all cases where power trucks have been used in the foundry industry. Power trucks move materials faster by virtue of their higher speeds and heavier unit loads, and the fact that they are easily manœuvrable assists in reducing delays throughout the whole sequence of the manufacturing process in a foundry.

The examples given show that by the careful study of the operations involved and the judicious use of power lathes, labour can be transferred to other essential work.

The New Technique

Power trucks should be considered not only on account of the labour they save, but also because they cater for conveying jobs that are extremely difficult to do by any other means. An example of this is the transportation of sand.

Sand is a difficult material to handle owing to its abrasive nature, and its tendency to stick, especially when moist or hot. In the transportation of new sand, coal dust, and sand from the knock-out to the conditioning and preparation department, and in its distribution to the moulding machines, the use of power trucks obviates the difficulties outlined.

The adoption, since, 1939, of new foundry technique in the casting of alloys, such as magnesium alloys, has created many more material-handling problems to be surmounted. The power truck handling system is readily adaptable to any revised technique or layout.

In foundries producing this kind of casting the power truck is mainly concerned with the conveying of patterns, core and core-racks, sand, moulding boxes and castings. In addition chills must be transported to the moulders, and after knocking-out these must be again transported to the shot-blasting for cleaning.

To finish the process the casting usually has to be shot-blasted after fettling, and then annealed to relieve casting stresses after shot-blasting—operations that require material-handling between times.

Finally, in the foundry the maintenance of machinery is a heavy duty. The avoidance of loss in production through breakdowns is dependent upon the maintenance gang's speed in getting the plant into operation again. The use of power trucks in conveying plant and equipment to the maintenance gang is of inestimable value in reducing time lag between breakdown and re-start; and again not only is lost time avoided, but valuable labour is saved by the avoidance of hand trucking by the millwright's labourers.

* Extracted from the "Production and Engineering Bulletin."

AMERICAN MECHANISATION

Mr. Kennard Lange, in an address he delivered to the Post-war Planning Conference organised by the [American] Gray Iron Founders' Society, had some very interesting remarks to make about the mechanisation of foundries. Only space restriction prevents us from publishing the whole of his Paper. He gave the following reasons as to why mechanisation was essential:—(1) Competition; (2) better castings at a lower price; (3) increased production without increasing floor area; (4) better conditions for the operative; and (5) increased opportunity for the removal of dust and fume.

In stressing the item "better working conditions," the Author remarks:—"The present flight of workers from the foundry industry is appalling." Mr. Lange's idea of a small jobbing shop is a little different from ours, as the American standard is 10 to 20 tons a day! For this class of concern "there is little question but that straight floor production with a minimum of equipment is most practical." Dealing with equipment, the following advice is tendered, "Accept clever ideas, but avoid extreme and tricky devices." Intermittent operation obviously involves extensive storage of moulds and, "strange as it may seem, the cost of mould storage and handling equipment exceed the cost of continuous power conveyors." American experience indicates that 2½ to 3 tons per hr. melt is about the minimum tonnage to be considered for continuous cupola operation. The increase in production through a sand- and mould-handling system will be from 50 to 200 per cent., depending on the conditions existing prior to their installation.

The Author has taken for an example a line of 10 moulders and gives the following information. The line is assumed to be making thin-sectioned light-weight castings, using match-plate patterns in scrap flasks in power squeeze machines. The average weight will be about 20 lbs.; the production—allowing for frequent pattern changes—30 moulds per hr.; the metal requirements, 3 tons per hr., allowing some metal to be used on the side floors; the sand supply of the order of 15 tons per hr. As foundry plant must be of robust construction, it costs but little more to supply a line of from 14 to 16 moulders. Under American conditions, it has been found that the cost of equipment erected and ready for use will range from £500 to £1,250 per moulding machine served. Maintenance, however, interest, depreciation, and operation service will average 3s. to 7s. 6d. per ton of castings made, working single shift. "From 100 to 150 tons of material are handled in the average foundry to produce 1 ton of castings, and mould handling represents 20 to 40 per cent. of the total." When continuous melting is practised, the Author advises the use of gravity roll conveyors capable of carrying one hour's storage capacity.

Other advice given is: "Foundries starting to mechanise would do well to develop an overall plan and to instal equipment in units rather than attempt to mechanise the whole foundry in one step." "Smaller foundries which would not be justified in complete mechanisation of even a single unit can profit from a small, compact, central sand reclamation and facing-sand preparation equipment." The American cost of such a plant is now of the order of $7,000 to $10,000, say at the current exchange of about £1,750 to £2,500. If a magnetic belt conveyor is included, then an extra allowance of £375 to £500 must be made. If any of our readers—other than overseas—desire to consult this Paper, we will post it along to them.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

564,516 UNITED AIRCRAFT CORPORATION. Apparatus for testing metals.

564,521 WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY. Method of producing corrosion resistant phosphate coatings on metal and alloy metal surfaces.

564,522 WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY. Method of producing compositions for activating metal and alloy surfaces to improve the process of forming corrosion-resistant phosphate coatings thereon.

564,526 ANDERSON, JUN., G. Manufacture of crane hooks and the like.

564,556 FAHLSTROM, O. I. Apparatus for forming hollow metal objects by means of hydraulic pressure.

564,582 GIBBONS BROS., LIMITED, MARLE, M. VAN, and WEBB, A. W. OGILVY-. Industrial furnaces.

564,597 BRITISH TITAN PRODUCTS COMPANY, LIMITED, and TINSLEY, S. G. Vitreous enamels.

564,598 JOHNSON, C. M. Forming and shaping sheet metal parts by means of rolls.

564,603 EVERY, C. E. (Titanium Alloy Manufacturing Company). Methods of purifying refractory carbon-containing compounds of titanium and zirconium.

564,627 WELLMAN SMITH OWEN ENGINEERING CORPORATION, LIMITED, and SMITH, C. H. Butterfly valves.

564,656 RADIATION, LIMITED, and PICKARD, J. C. Solid fuel or other stoves and firegrates.

564,664 E.M.B. COMPANY, LIMITED, and SMITH, S. Fluid operated die casting and like machines.

564,824 JARROW METAL INDUSTRIES, LIMITED, and BIRD, F. G. Melting of ferrous metals and their alloys.

564,835 PATERSON, J. H. Protective screens for welding and like industrial operations.

564,885 WEISS, S. M., and KENNEDY, F. J. Apparatus for pickling metals.

564,994 SAUNDERS, H. L. Charging devices for blast furnaces, kilns and similar shaft furnaces, ovens, gas-producers, sintering machines, bunkers, silos and the like.

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DALE Refined PIG IRON
The High-Quality Iron for High-Duty Castings.
Made in seven standard grades or to individual requirements, this iron has a close grain structure and fine graphitic carbon content. It replaces Hematite, and tones up high phosphorus irons.
We also make Dale Refined Malleable Iron to any required specification.
THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM

NEW YEAR HONOURS

SIR CHARLES BRUCE-GARDNER, KT., the well-known industrialist, becomes a baronet in the New Year Honours List. Sir Charles was lately Controller of Labour Allocation and Supply, Ministry of Aircraft Production. He is chairman of the Executive of Reconversion, Board of Trade, and of the Society of British Aircraft Constructors, Limited, and a member of the Air Supply Board. He was a member of the Sheet Trade Board, 1914-30, a member of the Sheetmakers' Conference, 1915-30, chairman of the Galvanising Conciliation Board, 1920-30, chairman of the Iron and Steel Industrial Research Council, 1929-30, a member of the Advisory Committee of the Department of Overseas Trade, 1929-30, and chairman of the London Iron and Steel Exchange, 1936 and 1937. Sir Charles has also held a number of other important appointments, while his interests extend also to the coal industry. He is chairman of the New Jarrow Steel Company, Limited.

Among the new Knights, the following are of interest to our readers:—

MR. PETER BOSWELL BROWN, chairman and managing director of Hadfields, Limited, and a director of John Baker & Bessemer, Limited, the Lilleshall Company, Limited, and the Tinsley Rolling Mills Company, Limited. Mr. Brown is a member of the Council of the Iron and Steel Institute, a member of the management board of the Engineering and Allied Employers' National Federation, and vice-president of the British Iron and Steel Federation.

MR. ROY HARDY DOBSON, managing director of A. V. Roe & Company, Limited.

MR. ARTHUR PERCY MORRIS FLEMING, a director of Metropolitan Vickers Electrical Company, Limited, receives the honour for services to education. He is also a director of Walthamstow & Associated Insulation Products, Limited, and Micanite & Insulators Company, Limited. He was largely responsible for the development of the works' school and apprenticeship systems at Metropolitan Vickers Electrical Company. He is a member of the Council of the British Electrical Research Association, and a past-president of the Institution of Electrical Engineers, 1938-39, and was a recipient of their Faraday Medal in 1941.

MR. MARK HODGSON, general secretary of the United Society of Boilermakers and Iron and Steel Shipbuilders.

MR. ALLAN CAMPBELL MACDIARMID, chairman and managing director of Stewarts and Lloyds, Limited. Mr. Macdiarmid qualified as a chartered accountant and joined Stewarts and Lloyds as secretary in 1909. He is chairman of Cochranes (Middlesbrough) Foundry, Limited, Clydeside Tube Company, Limited, Holwell Iron Company, Limited, Islip Iron Company, Limited, Lloyds Ironstone Company, Limited, New Crown Forgings, Limited, Prothero Steel Tube Company, Limited, Scottish Tube Company, Limited, Stanton Ironworks Company, Limited, Tubewrights, Limited, United Tube (Holdings), Limited, Wellingboro'

(*Continued at foot of next column.*)

STEEL INDUSTRY AT BARROW

SUPPLY MINISTRY'S SURVEY

A deputation from Barrow-in-Furness has interviewed the Ministry of Supply regarding the future prospects of the steel industry at Barrow. Sir Josiah Walker-Smith, M.P., explained that they were perturbed at the possibility of the closing down of the works now owned by the Ministry.

Sir Andrew Duncan, the Minister of Supply, received the deputation. There were also present Mr. C. U. Peat, M.P., Parliamentary Secretary; Sir William Douglas, Permanent Secretary; and Mr. O. S. Franks, Second Secretary.

Sir Andrew Duncan said the Board of Trade were preparing a report which would give a broad survey and focus the issues of policy and the facts of importance with a view to Ministerial decisions. He hoped the report would be presented to the Government some time in January.

Mr. Franks explained, in reply to a question, that the Ministry, in view of their close connection and responsibility for the industry during the war, were covering the whole field, in consultation with the Board of Trade, in their review, and were not simply concerned with the narrower Ministry of Supply interest. There had been substantial changes over the last five years, large new developments leading to a surplus capacity in some directions and a hold-up of development in others. He agreed that the labour position in the different areas would be one of the most important factors for consideration in the Government's review.

MINISTRY OF ECONOMIC WARFARE

As recently announced, arrangements are being made for winding up the Ministry of Economic Warfare. The Prime Minister has decided that, when these arrangements are complete, the remaining functions of the Ministry will be transferred to the Foreign Office. The date for this change, which was originally expected to be at the end of December, has now been postponed for the time being.

(*Continued from previous column.*)

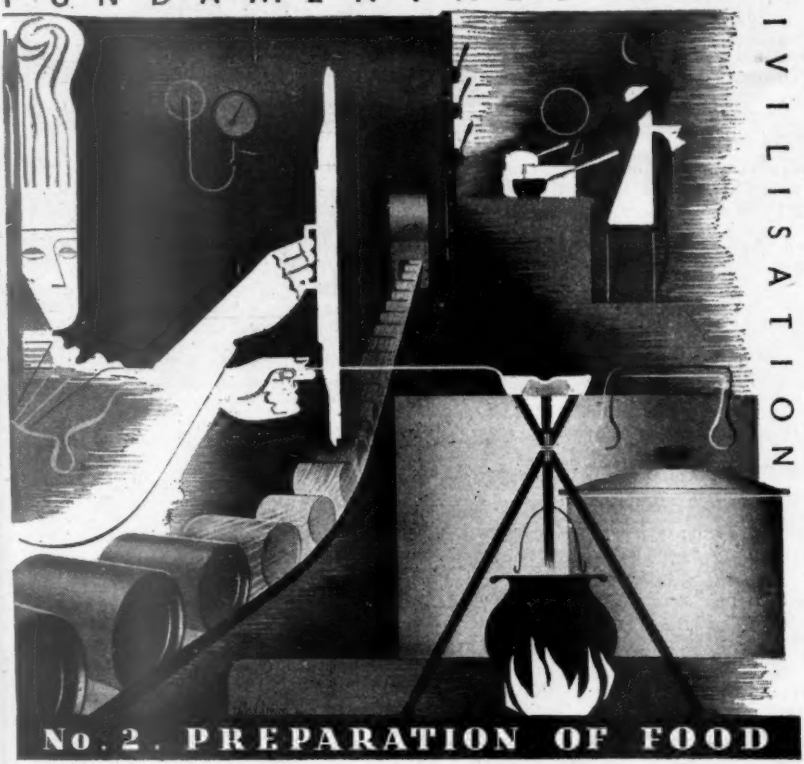
Iron Company, Limited, and other companies, and a director of many firms, including Tube Investments, Limited, the United Steel Companies, Limited, Richard Thomas & Company, Limited, and the British Iron and Steel Corporation.

MR. GEOFFREY LE MESURIER MANDER is chairman of Aerostyle, Limited, and vice-chairman of Tung Oil Estates, Limited.

MR. ARTHUR EVAN MORGAN is a director of the Vulcan Boiler & General Insurance Company, Limited, and other insurance companies.

MR. ARTHUR FREDERICK SIDGREAVES, managing director of Rolls-Royce, Limited.

FUNDAMENTALS OF CIVILISATION



No. 2. PREPARATION OF FOOD

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Man cooks his food and thus differentiates himself from the animals. By applying heat to the ancient cooking pot, it was discovered that food was not only made palatable but was also preserved.

The original cooking of food as a satisfying appeal to the appetite also unconsciously served the needs of hygiene.

In modern times, the degree of hygiene attained in the preparation and preservation of food has become a measure of civilisation. The housewife has her stainless steel kitchen-ware for ease of cleansing, the chef has his untarnishable equipment; and, in the large scale preparation of food, are to be seen vast cauldrons and fabricated vessels of these new gleaming steels.

In the dairy, the butcher's shop, the brewery and in the great canning industries, stainless steel is an up-to-date symbol of progress.

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WORKINGTON IRON & STEEL CO., WORKINGTON
THE SHEFFIELD COAL CO. LTD.
THE ROTHERVALE COLLIERIES, TREETON
UNITED COKE & CHEMICALS CO. LTD.
THOS. BUTLIN & CO., WELLINGBOROUGH

U.S.P. 26

COMPANY RESULTS

(Figures for previous year in brackets.)

Gjers Mills—Interim dividend of 2½% (same).

Birfield Industries—Dividend on the ordinary stock of 12½% (same).

Bertrams—Profit to September 30 last, £13,492 (£13,480); dividend of 10% (same); forward, £5,690 (£3,948).

Joshua Bigwood & Son—Trading profit for the year to September 30, after tax, £20,868 (£20,417); depreciation, £5,783 (£7,293); dividend of 10% (same); forward, £12,898 (£7,594).

A. E. Jenks & Cattell—Net profit to August 5 last, £22,758 (£27,324); to general reserve, £7,000 (£15,000); ordinary dividend of 10%, tax free (same); forward, £46,050 (£43,217).

John Holroyd & Company—Net profit, after E.P.T., for the year to September 30, 1944, £59,493 (£58,297); income-tax, £36,000 (£33,500); dividend of 20% (same); forward, £51,219 (£42,726).

Hale & Hale (Tipton)—Net trading profit to August 4 last, £25,186 (£22,311); depreciation, £7,492 (£5,983); to general reserve, £5,000 (£2,500); obsolescence reserve, £2,500 (nil); tax reserve, nil (£7,500); ordinary dividend of 15% (10%); forward, £9,395 (£9,837).

Cleveland Bridge & Engineering—Net trading profit to September 30, 1944, after all charges, including taxation, £54,967 (£22,106). This year's figure includes profits earned on the New Howrah bridge contract, which was completed during the year. Dividend of 4½%, free of tax (same); to reserve, £35,000 (£2,000). The figure of £35,000 represents the net profit, less tax, earned on the New Howrah bridge contract in the years prior to the introduction of E.P.T. at 100%. The balance of profits on this contract is included in the reserve for taxation, etc. Forward, £5,582 (£5,470). (same) on the ordinary shares; to reserve, £10,000 (£15,000); forward, £24,377 (£24,167).

CONTRACTS OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Birkenhead, January 10—Iron castings, wrought iron, etc., and steel reinforcement, for the year ending March 31, 1946, for the Corporation. The Borough Engineer and Surveyor, Town Hall, Birkenhead.

Spalding, January 15—Construction, completion and maintenance of approx. 18,920 yds. of 3-in. dia. spun-iron pipes, together with sluice valves, hydrants and ancillary work, for the Rural District Council. Mr. E. J. S. Maples, clerk, Council Offices, 7, The Crescent, Spalding. (Fee £2, returnable.)

Stratford-upon-Avon, January 12—Provision and laying of approx. 840 yds. of 8-in. dia. and 1,280 yds. of 7-in. dia. cast-iron water mains, for the Borough Council. Mr. P. C. Smart, borough engineer, Municipal Offices, Stratford-upon-Avon. (Fee £1, returnable.)

PERSONAL

COL. MARK FIRTH has been awarded the O.B.E. (Military Division) for meritorious service in the Home Guard. He is a director of Thos. Firth & John Brown, Limited, Sheffield.

MR. S. W. RAWSON has been elected chairman of Michell Bearings, Limited, of Newcastle-upon-Tyne, in succession to the late Sir Charles Craven. COMMANDER E. R. MICKLEM, R.N., has been appointed a director.

MR. G. B. KING has been appointed Regional Controller for the Midlands under the Ministry of Production, and also chairman of the Midland Regional Board. The appointment arises out of the retirement on grounds of health of Col. H. B. Sankey.

MR. F. PICKWORTH has been appointed managing director of the English Steel Corporation, Limited, and its subsidiaries, the Darlington Forge, Limited, and Industrial Steels, Limited. MR. F. S. BEALE, at present assistant secretary, is now appointed secretary of the Corporation.

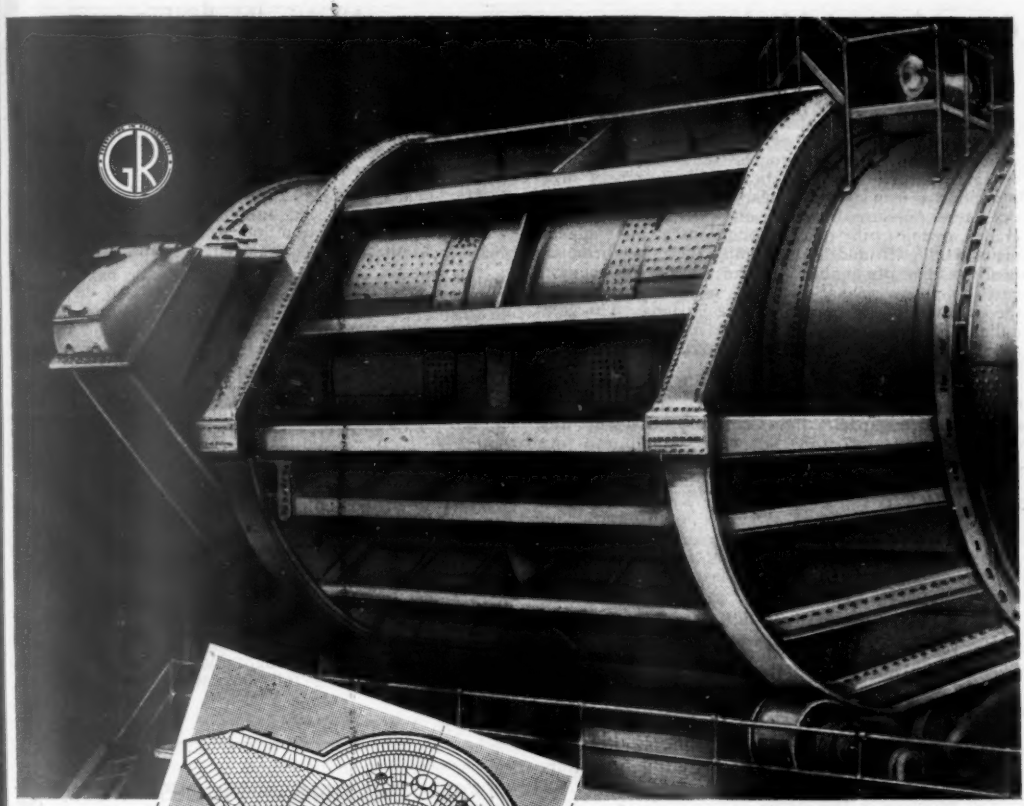
MR. L. SHORT, manager of the Dumbuck Works of Babcock & Wilcox, Limited, at Dumbarton, retires at the end of the year. Suffolk born, Mr. Short's first shop and drawing office experience was gained as an apprentice with Charles Burrell & Sons, Thetford. In 1893, he went to Marshall, Sons & Company, Gainsborough, staying there until 1905, when he became works manager to Robey & Company, Lincoln. Later he was manager and engineer to Davy, Paxman & Company, Colchester. He went to the Dumbuck factory at Dumbarton in 1915, when it was being equipped for the production of shells for the Admiralty. At the close of the last war it was decided to commence the manufacture of boiler accessories and valves at Dumbarton, and year by year since the enterprise has entailed the adding of new buildings. Mr. Short will remain with Babcock & Wilcox in a consultative capacity.

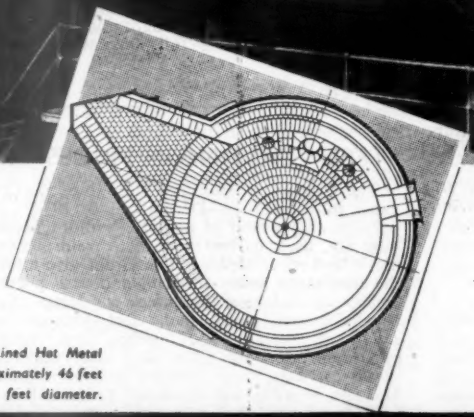
OBITUARY

MR. ARTHUR HERBERT SMITH, London manager of Holman Bros., Limited, mining plant manufacturers, ironfounders, etc., of Camborne, Cornwall, died on December 19, following a short illness. He was 72.

MR. C. M. HODKINSON, who died recently at the age of 57, was well known in the Sheffield district and the West Riding of Yorkshire, where he had been since 1930 the representative for Darwins, Limited, and Andrews Toledo, Limited. He joined the latter organisation forty years ago.

MR. EDWARD ROBERTS, of Heaton, Bolton, a director of Mather & Platt, Limited, Manchester, died recently. He was in his 80th year. He was apprenticed in 1881 to Dowson & Taylor, of Bolton, one of the earliest fire-sprinkler makers in Lancashire, and the improvement of fire-preventing plant of the type became his chief engineering interest. When the firm moved to Manchester he went with it, and soon after became a director.





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Raw Material Markets

IRON AND STEEL

A definite improvement can be recorded in the outlook for the light-castings trade, an improvement which promises to be progressive as the rehousing schemes mature. Already the current output of high-phosphorus iron is fully absorbed, but there is not the same pressure for low- and medium-phosphorus grades, owing to the quieter conditions at the engineering and allied foundries. Supplies of refined iron are fairly readily obtainable, but the scarcity of hematite persists and no relaxation of the severe restrictions on the use of this grade appears to be in sight. The great difficulty is the scarcity of suitable ores, and in consequence the predominant use of native ironstone of low metallic content.

While there have been a few cancellations of orders for light re-rolled material, the works are still operating at or near capacity limits, and are taking up substantial tonnages of prime billets, sheet bars, etc. An indication of the heavy demand for re-rolling material is the fact that there are plenty of outlets for the disposal of defective billets and bars and shell discard steel, more of which has come on to the market of late.

Both the plate and section mills are turning out a preponderance of light material, heavy sizes having a neglected appearance. The lighter gauges of sheets are also more generally specified, though the mills have a big volume of orders for all classes of sheets, both black and corrugated. Production of shell bars has been speeded up considerably and many sources contribute to the extensive demand for small steel bars. Rail mills and rollers of colliery material will begin the new period with substantial orders in hand, and although there has been no expansion in the more limited requirements of the shipyards, the steel furnaces and mills are more favourably placed than seemed probable a few weeks ago.

Ferro-tungsten has been reduced in price from 9s. 8d. to 6s. 10d. per lb., and tungsten metal powder from 9s. 9½d. to 7s. 4½d.

NON-FERROUS METALS

It may be expected that as 1945 progresses releases of the non-ferrous metals will be on an increasing scale. Consumption for war purposes is down very considerably compared with twelve months ago, and there is unlikely to be any great expansion now despite the lavish use of munitions on the Western front. Copper, lead and zinc are all now more freely available than at any time since the war began, and further relaxation of the restrictions will undoubtedly be forthcoming. In spite of enemy occupation of the Far Eastern tinfields, there is no real shortage of tin for war purposes, but, obviously, careful use of the available supplies must be observed for some time to come.

NEWS IN BRIEF

CHEADLE HEATH TOOL & GAUGE MANUFACTURERS, LIMITED, is being wound up voluntarily. Mr. J. Lacy, 25, Great Underbank, Stockport, is the liquidator.

THE MINISTER OF SUPPLY has made the Control of Iron and Steel (No. 38) (Scrap) Order, 1944, which came into operation on December 30 reducing the prices of scrap steel containing tungsten.

MR. PERCY PHILLIPS, 76, New Cavendish Street, London, W.1, has been appointed liquidator, with a Committee of Inspection, of Repetition Engineering Service, Limited, 47, Clapham High Street, S.W.4.

THE PRESIDENT OF THE BOARD OF TRADE has had set up a Central Council of Industrial Design, with a Scottish committee, to encourage by all practical means the adoption of good design in British industry. Industries will be encouraged to set up design centres, and the Government propose to make financial grants for this purpose.

THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION, LIMITED, announce that as from January 1 the secretariat of the Association will be undertaken by Peat, Marwick, Mitchell & Company, 94, Petty France, London, S.W.1, to whom communications relating to Association and Dextrine Control matters should be addressed.

RAILWAY CONTROL is likely to go on "with general agreement of all concerned" longer than one year after the cessation of hostilities, declared Mr. P. J. Noel-Baker, the Parliamentary Secretary, Ministry of War Transport, in the House of Commons recently. It would be more likely to last for two years than one after the war, and he thought that if that were done it would be with the full agreement of the railway companies.

STEEL CASTINGS PRICES REVISED

The Control of Iron and Steel (No. 37) Order, 1944, came into force on December 30, 1944. The Order permits any person to acquire, without licence, in any quantity, used barbed wire, wire reinforcement fabric mesh, and wire staples. The Order also alters some of the maximum prices for iron and steel products, principally by reducing the prices for ferro-tungsten electrically melted steels, shell steel discards, high speed steel and certain alloy steels, and increasing the maximum prices for other alloy steels and for medium plates, springs, and wrought-iron tubes and fittings. Maximum prices are provided for the first time for high speed steel drill rods, crank axles and parts, cold drawn Admiralty boiler tubes and gun billets.

Prices of steel castings have been revised by varying the previous over-all increase as between different classes of castings, resulting in some reductions and some increases in the prices.

Copies of the Order may be obtained from H.M. Stationery Office, price 1d. (S.R. & O., 1944, No. 1440.)